

WHAT IS CLAIMED IS:

1. An anti-reflection film that is an optical film, comprising, at least, a hard coat layer, and a low-
5 refractive-index layer containing a binder polymer, on a transparent support,
wherein said hard coat layer and/or said low-refractive-index layer contains:
- (a) a hydrolysate of an organosilane in which a
10 hydroxyl group or a hydrolysable group is directly bonded to silicon, and/or a partial condensation product thereof; and
- (b) at least one metal chelate compound of an alcohol represented by formula R^3OH , in which R^3
15 represents an alkyl group having 1 to 10 carbon atoms, and a compound represented by formula $R^4COCH_2COR^5$, in which R^4 represents an alkyl group having 1 to 10 carbon atoms, and R^5 represents an alkyl group having 1 to 10 carbon atoms or an alkoxy group having 1 to 10 carbon atoms, as ligands,
20 and a metal selected from the group consisting of Zr, Ti and Al, as a central metal.
2. The anti-reflection film according to Claim 1, wherein said hard coat layer contains an inorganic filler
25 composed of an oxide of at least one element selected from

the group consisting of zirconium, titanium, aluminum, indium, zinc, tin, antimony and silicon.

3. The anti-reflection film according to Claim 1,
5 wherein said low-refractive-index layer contains an inorganic filler selected from silica and magnesium fluoride.

4. The anti-reflection film according to Claim 1,
10 wherein at the surface on said low-refractive-index layer side, a coefficient of dynamic friction is in the range of 0.03 to 0.15, and a contact angle to water is in the range of 90 to 120°.

15 5. The anti-reflection film according to Claim 1, wherein a surface energy of said hard coat layer is in the range of $25 \text{ mN} \cdot \text{m}^{-1}$ to $70 \text{ mN} \cdot \text{m}^{-1}$.

6. The anti-reflection film according to Claim 1,
20 wherein said binder polymer in the low-refractive-index layer is a fluorine-containing polymer.

7. The anti-reflection film according to Claim 1,
wherein said organosilane of (a) the hydrolysate of an
25 organosilane, in which a hydroxyl group or a hydrolysable

group is directly bonded to silicon, and/or the partial condensation product thereof, is an organosilane represented by formula (A):

5 Formula (A) $(R^{10})_{m1}-SiX_{n1}$

in which R^{10} represents a substituted or unsubstituted alkyl or aryl group; X represents a hydroxyl group or a hydrolysable group; $m1$ represents an integer of 0 to 3;
10 and $n1$ represents an integer of 1 to 4, in which the total of $m1$ and $n1$ is 4.

8. The anti-reflection film according to Claim 7, wherein the group R^{10} of said organosilane in formula (A)
15 is a group containing an epoxy group, or a (meth)acryloyl group.

9. The anti-reflection film according to Claim 1, wherein said binder polymer in the low-refractive-index
20 layer is a fluorine-containing polymer that is a perfluoroolefin copolymer.

10. The anti-reflection film according to Claim 1, wherein said binder polymer in the low-refractive-index
25 layer is a fluorine-containing polymer that has a recurring unit containing a radical polymerizing group or

a cation ring-opening polymerizing group at a side chain of said fluorine-containing polymer.

11. A method of producing an anti-reflection film
5 according to Claim 1, comprising:

at least, coating a hard coat layer and a low-
refractive-index layer containing a binder polymer, on a
transparent support,
wherein a coating solution of said hard coat layer and/or
10 a coating solution of said low-refractive-index layer
comprises:

the hydrolysate of said organosilane and/or the
partial condensation product thereof represented by (a);
the metal chelate compound represented by (b); and
15 (c) a β -diketone compound and/or a β -ketoester
compound represented by formula $R^4COCH_2COR^5$, in which R^4
and R^5 each have the same meanings as those in the (b).

12. A polarizing plate, comprising a polarizing
20 layer and two sheets of protective films of the polarizing
layer,
wherein at least one of said protective films comprises
the anti-reflection film according to Claim 1.

25 13. A polarizing plate, comprising a polarizing

layer and two sheets of protective films of the polarizing layer,
wherein at least one of said protective films comprises the anti-reflection film produced by the production method
5 according to Claim 11.

14. A display device, having the anti-reflection film according to Claim 1,
10 wherein the low-refractive-index layer is arranged on the viewer side.

15. A display device, having the anti-reflection film produced by the production method according to Claim
15 11,
wherein the low-refractive-index layer is arranged on the viewer side.

16. A display device, having the polarizing plate
20 according to Claim 12,
wherein the low-refractive-index layer is arranged on the viewer side.

17. A display device, having the polarizing plate
25 according to Claim 13,

wherein the low-refractive-index layer is arranged on the viewer side.

18. A hardening composition, comprising:

5 a hydrolysate of an organosilane represented by formula (1), which is produced in the presence of an acid catalyst, and/or a partial condensation product thereof:



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wherein, in formula (1), R^{10} represents a substituted or unsubstituted alkyl group, or a substituted or unsubstituted aryl group; X represents a hydroxyl group or a hydrolysable group; and m represents an integer of 1 to 3,

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wherein a component having a molecular weight of 1,000 to 20,000 accounts for 80% by mass or more of components having a molecular weight of 300 or more among the hydrolysate of said organosilane and/or the partial condensation product thereof.

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19. A hardened film, which is obtained by hardening a hardening composition according to Claim 18, wherein a degree of condensation of the hydrolysate of said organosilane and/or the partial condensation product

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thereof according to ^{29}Si -NMR analysis is in the range of 0.5 to 3.5.

20. An anti-reflection film, comprising, at least,
5 a hard coat layer and a low-refractive-index layer on a transparent support,
wherein said hard coat layer and/or said low-refractive-index layer comprises the hardened film according to Claim 19,
10 wherein said acid catalyst is an organic acid having 4.5 or less of an acid dissociation constant, pKa value at 25°C, in water, and
wherein the hydrolysate of said organosilane and/or the partial condensation product thereof, which is produced by
15 using an alcohol with substantially no addition of water as a solvent, is employed.